THE NEW HAMPSHIRE
AMBIENT AIR MONITORING PROGRAM
2011/2012 ANNUAL NETWORK REVIEW & PLAN

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New Hampshire
Department of Environmental Services

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2011/2012 ANNUAL NETWORK REVIEW & PLAN

prepared by
Ambient Air Monitoring Program

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Table of Contents

List of Tables

List of Figures

Acknowledgements

Introduction

The New Hampshire Department of Environmental Services (DES) respectfully submits this 2011/2012 Ambient Air Monitoring Program Annual Network Review Plan in accordance with the *Code of Federal Regulations Title 40, PART 58.* DES would like to thank the United States Environmental Protection Agency (EPA) for continuing support for improving and maintaining New Hampshire's Air Monitoring Network. Part 1 of this Plan reviews structure, objectives, recent history and data trends associated with DES' Air Monitoring Program (AMP). Part 2 of this Plan details individual air monitoring station information.

Part 1: 2011/2012 Annual Network Review and Plan

In our efforts to improve performance and maximize network efficiency under a constrained budget, DES has effected a number of changes over this report period – detailed in Network Modifications, Part 1. Key objectives remain to provide quality ambient air data to determine attainment status with the NAAQS - National Air Quality Standards (Table 1.1); guide future policy decisions at the state, national, and international levels; and protect public health through real-time mapping and air pollution alert initiatives. DES continually revisits and stresses basic air monitoring fundamentals and efficiency initiatives to allow for reliable, high quality data capture and analysis. Tables 1.6 through 1.9 at the end of this section summarize the current status of the New Hampshire ambient air monitoring network – July 2010 through June 2011.

Monitoring Objectives
In the interest of public health and the environment, DES operates a network of air monitoring sites throughout the state. These sites facilitate monitoring of ambient ozone, sulfur dioxide, nitrogen dioxide, certain air toxics, volatile and semi-volatile organic compounds, carbon monoxide, and particulate matter. DES' mission is "to help sustain a high quality of life for all citizens by protecting and restoring the environment and public health in New Hampshire." Air monitoring data from DES' network helps determine the status of air quality coming into New Hampshire from areas upwind, predict air pollution episodes, enact protective actions and warnings, develop and assess effectiveness of emission reduction strategies, support health assessments and NAAQS reviews.

Ambient air pollution monitoring began in New Hampshire in the 1970s with a few locations and grew to where each of the state's ten counties hosted monitoring stations for air pollutants known to be released in the area. Over time, pollution controls were installed and facilities shut down, allowing the air quality in those counties to improve well into the good zone. For example, paper mills in Coos County used to emit fairly high levels of sulfur dioxide and particles into the air resulting in periodic unhealthy air quality. Most of these facilities have since shut down and the air quality has improved to the point that there is a reduced need for monitoring in the area, and thus monitoring resources have been reallocated. However, DES continues to track emission inventories and reports of health concerns in these areas in order to assess if air monitoring should return to the area.

In recent years, DES and EPA have reduced the number of individual monitoring stations in order to meet demands for ever increasing network efficiency with limited resources. DES has

given careful consideration to how the need for efficiency would affect network consolidation while maintaining adequate public protection and the ability to track progress. In 2011, the network actually grew by one station with the addition of a new super station in suburban Londonderry as part of the NCore monitoring program. This station was carefully selected to be representative of typical New Hampshire population in a portion of the state that is heavily populated, growing, and where historical monitoring has demonstrated periodic events of unhealthy air quality.

The current New Hampshire ambient air monitoring network is carefully configured to provide air quality data in populated areas which are potentially at risk for unhealthy air quality of one or more pollutants. Most populated areas are represented by an air monitoring station unless previous monitoring has demonstrated that either the community is not at risk or can be adequately represented by a nearby monitor. Topography, geographic coverage, and air pollution modeling were also considered in the current network design.

In 2011, most of the major pollution sources that are in operation in New Hampshire are generally well controlled. Areas of continued concern are mobile and area sources where population density and highway networks are dense enough to multiply the emissions of relatively small individual sources hundreds of thousands of times over. The cumulative emissions are greatest in the southeastern portion of the state where population and highway densities are greatest. This region is generally bounded by the Massachusetts state line to the south, Nashua and Manchester to the west, Concord to the north, and Rochester and Portsmouth to the east. This same region is also the most exposed portion of the state to air pollution transport which generally crosses the southeastern part of the state from southwest to the northeast and along the New Hampshire coastline.

Pollutants of most concern in this area include ozone, ozone precursors (nitrogen oxides and volatile organic compounds), small particles ($PM_{2.5}$), and sulfur dioxide. The monitoring network is most dense in this region to reflect these air quality concerns and the dense population. While the greatest risk of unhealthy air quality occurs in the southeastern portion of New Hampshire, unhealthy air quality events can occur anywhere in the state for ozone and small particles; thus the monitoring network for these pollutants extends into all portions of the state. Small particles also lead to visibility impairment, and there are federal regulations to track visibility progress with a special kind of speciation monitoring (IMPROVE) near the Class I (pristine) airsheds located adjacent to Mt. Washington in northern NH.

Network Summary
Below is a brief summary of the New Hampshire Air Monitoring network and the role each station plays for public protection. The list is presented alphabetically by community.

Concord
The Concord monitoring site is primarily intended to track ozone, the only criteria pollutant for which recent air monitoring and modeling have indicated possible population exposure to unhealthy levels. A previous Concord monitoring station was located in the valley near I-93, but it was felt by DES that the nitrogen oxides emitted by the high volume of interstate traffic at freeway speeds would create a bubble of NOx scavenging, lowering the measured ozone levels in the immediate area. The current location has significantly lower NOx emissions and is close to residential neighborhoods, retirement communities, and schools. DES initiated SO_2 monitoring

at this station during October 2010 to help quantify local SO_2 levels in concert with the new SO_2 NAAQS. This station represents population exposure on a neighborhood scale.

Greens Grant – Mt. Washington base
The Greens Grant, Camp Dodge ozone monitor at the base of Mt. Washington is now the primary monitor representing the northern portion of NH. This monitoring location is also important since it represents two federally recognized Class I airsheds which also require visibility monitoring (IMPROVE). DES tracks PM2.5 levels estimated by IMPROVE for the purpose of estimating current exposures and the demand for more comprehensive PM2.5 monitoring. Previous monitoring in the north country (Pittsburg and Conway) has been consolidated at Camp Dodge due to the high correlation between sites, low population densities, and low risk of exposure to unhealthy air quality. Currently, ozone poses the highest risk for an unhealthy air event in the North Country. This research oriented station represents population exposure on a regional scale.

Keene
The monitoring station in the city of Keene tracks ozone and $PM_{2.5}$ on a continuous basis. The southwest portion of the state experiences a few days per year when ozone levels have the potential to reach unhealthy levels, justifying ozone monitoring. $PM_{2.5}$ levels have also been of concern, in winter as well as in summer. The Keene station was recently upgraded with continuous $PM_{2.5}$ monitoring equipment to better track the risks of wintertime wood smoke buildup. Keene is a prime example of a city distinguished by the factors, such as population density, woodstove use, and valley topography, that are necessary for these winter events, and other nearby communities may be similarly affected. The continuous $PM_{2.5}$ equipment has been invaluable in better understanding the winter $PM_{2.5}$ events and improving air pollution forecasts for the area. The data measured for ozone and non-winter $PM_{2.5}$ are considered valuable on a regional basis, and the data for winter $PM_{2.5}$ is considered non-regional. This station represents population exposure.

Laconia
The Laconia monitor tracks ozone in the "Lakes Region" of the state, whose population swells during the summer months with tourists. The monitor represents the very northern edge of the Boston CMSA (combined metropolitan statistical area) and periodically experiences elevated ozone levels. This station represents population exposure on a regional scale.

Lebanon
The Lebanon monitoring station is sited to provide population and regional based monitoring for the Lebanon/White River Junction (VT) metropolitan area with information on regional ozone and $PM_{2.5}$. This site is also important since it represents the consolidation of the closed Claremont (ozone) and Haverhill (ozone and $PM_{2.5}$) monitoring stations. The station is located on the ridge at Lebanon airport, just above the river valley. The site was primarily chosen to represent the regional exposure, and the station is important to the New Hampshire network for its geographic coverage.

Londonderry
The Londonderry station came online January 1, 2011 as an NCore super station measuring a wide selection of pollutants. DES worked closely with EPA to carefully select this site for its central proximity to the highly populated southeastern suburban portion of New Hampshire. The

site has no nearby emission sources of significance, but lies in the air pollution transport corridor that crosses the southern portion of the state. The site is expected to track a number of unhealthy ozone events each year. Being a multi-parameter station located in an area representative of a large population living in the northern suburbs of Boston, the data collected at this site will be ideal for future research and health-related analysis. This station represents population exposure on a regional scale.

Manchester
The Manchester station is currently located in a parking lot in the urban center of the city. It tracks a number of pollutants including $PM_{2.5}$, SO_2, and CO. The location is important for tracking CO for maintenance purposes (previous nonattainment) and for its urban $PM_{2.5}$ tracking.

In getting the Londonderry station online, a number of the monitoring units have been relocated there from Manchester, but CO and $PM_{2.5}$ continue to be measured in Manchester because of their urban nature. While ozone in the city occasionally exceeds the NAAQS, the urban location is NOx rich and scavenges (reduces) measured ozone levels within the downtown area. The location often measures lower ozone levels than seen at nearby Londonderry, Nashua and Concord. The new nearby NCore station in Londonderry, which represents the Manchester suburbs where there is less NOx, is expected to show higher ozone levels than seen in Manchester and will thus be more protective. This Manchester station represents population exposure on an urban scale.

Mt. Washington – Summit
The Mt. Washington summit monitoring site is of special value for scientific research for tracking ozone transport. The summit is located at 6288 feet above sea level and is far away from any significant pollution sources; thus it is ideal for picking up long-range pollution transport into the northern portion of the state. The data are often compared to the data collected at Greens Grant (Camp Dodge) located at the base of the mountain, just a few miles to the east, to give a vertical gradient perspective. Ozone levels measured at the summit are normally higher than measured at the base and occasionally reach unhealthy levels. This station provides valuable high elevation data on a regional scale.

Nashua – Crown Street
The Crown Street monitoring station represents urban $PM_{2.5}$ within the city of Nashua. This station will continue to track urban population-based $PM_{2.5}$.

Nashua – Gilson Road
In recent years, the Nashua area has often seen the highest ozone concentrations in the state and there is an ongoing need to continue tracking ozone in this area well into the future. The Gilson Road monitoring station also includes photochemical assessment monitoring (PAMS), which measures important precursors to the development of ozone. These precursors include a wide variety of volatile organic compounds and nitrogen oxides. While this station is on the upwind side of the city of Nashua, it is critical to the network for tracking transport into the state and into the city of Nashua from the southwest. This station also pairs with the Pack Monadnock station to give the low elevation perspective as compared to Pack Monadnock's high elevation data for similar air masses transported into the area. This station represents population exposure on a regional scale.

Peterborough, Pack Monadnock Mountain – Summit
Pack Monadnock station is the state's second NCore site, with NCore parameters coming online January 1, 2011. However, several parameters have been monitored at this site for a number of years. The site's true value lies in the fact that it is located on a rural mountain top in the south-central portion of the state. At 2288 feet above sea level, the station is ideally located to pick up the transport airflow from the heavily populated northeast urban corridor (Washington, D.C. to Boston, MA.) and is at the northern terminus of the low-level jet that begins near the middle of Virginia. This non-population-based monitor does not have nearby sources of significance. This site measures a wide variety of pollutants, including PAMS ozone precursors, IMPROVE visibility speciation measurements, ozone, and $PM_{2.5}$. The location is of high scientific value for regional and transport elevation, measurements on a regional scale.

Pembroke
The Pembroke monitoring station is located along the Merrimack River, just to the south of Merrimack Station power plant. The power plant is a large coal burning source with relatively high levels of SO_2 emissions. While the power plant is currently undergoing pollution control upgrades for SO_2, this station is critical for tracking progress and for its measurements of exposure in a nearby community. This station represents population exposure on a local scale.

Portsmouth
The Portsmouth monitoring station is located on Pierce Island on the Piscataqua River just to the east of downtown Portsmouth. DES has been successful in establishing a long-term agreement for siting at its current location and has found the location to be suitable for tracking emissions from around the Portsmouth and Kittery (ME) areas. The station also picks up some sea breeze ozone events that work their way up the river. This station represents population exposure on a limited regional scale.

Rye
The Rye Monitoring station is located at Odiorne State Park primarily to track summertime sea breeze-generated ozone events. Past experience monitoring ozone in Rye found that sea breeze events sometimes generate the highest ozone in the state. These events target the coastline area and rarely penetrate more than a few miles inland. The data from this site are of scientific interest for air pollution flow dynamics when compared with data from Portsmouth station and the UNH sponsored ozone monitor located about 13 miles offshore on the Isle of Shoals. This station represents a specific and limited population along the New Hampshire coastline for periodic high ozone events.

Woodstock
The Woodstock monitoring station is a CASTNET site operated by EPA for trends monitoring. DES supports this site and uses the data for regional ozone tracking.

Beta Attenuation Federal Equivalency Method (FEM) Monitoring
DES has implemented FEM continuous (hourly) $PM_{2.5}$ sampling at several stations with Met One BAMs (FEM EQPM-0308-170). To date, DES operates BAMs at the Keene, Lebanon, Londonderry, Pack Monadnock, and Portsmouth stations. DES plans on adding a BAM to the Pembroke station, but has not secured the funding at this time. Whenever BAMS are collocated and operated in conjunction with Federal Reference Monitors (FRM) samplers, DES will use the

FRM data, once validated, as primary data toward $PM_{2.5}$ NAAQS compliance determination. The BAM data will be used as primary data when the FRM is not available.

Network Modifications

DES made several modifications to the air monitoring network between July 1, 2010 and June 30, 2011. Modifications consisted of new site and monitor installations, infrastructure development, and discontinuation of select monitors. Specific network modifications include the following:

Concord, Hazen Drive
- Initiated SO2 Monitoring – DES initiated SO_2 monitoring at this location during October 2010 to gather information relative to SO_2 NAAQS designation.

Londonderry, Moose Hill School
- Initiated NCore Sampling – DES designed, managed and initiated operation of an energy efficient, solar-supplemented NCore station at the Moose Hill School in Londonderry. All parameters associated with NCore were operational on January 1, 2011.

Manchester, Pearl Street
- Discontinued NO_2, PM_{10}, and PM_{10} Collocation – DES discontinued these parameters in coordination with starting up the NCore station in Londonderry. DES initiated PM10 collocation at our station in Portsmouth.

Nashua, Crown Street
- Altered $PM_{2.5}$ Filter Based Sampling Frequency – DES changed the $PM_{2.5}$ FRM run frequency from once every three days to once every six days at this station starting on January 1, 2011.

Peterborough, Pack Monadnock Mountain – Summit
- Initiated NCore Sampling – DES initiated operation of an NCore station on Pack Monadnock in Peterborough. All parameters associated with NCore were operational on January 1, 2011.
- Replaced Tapered Element Oscillating Mibrobalance (TEOM) with a BAM – DES replaced the 8500AB TEOM with a Met One BAM FEM during the first week of May 2011. The BAM is currently operating out of a Wells Cargo trailer specifically designed for air monitoring needs until the new station construction is complete (see below).
- Constructing a New Station for NCore – Due to space limitations in the current air monitoring structure, DES is modifying the Old State Police Building at base of the fire tower on Pack Monadnock Mountain to meet NCore monitoring needs. DES started the construction phase for this project during October 2010 and anticipates the new station will be completed by September 2011.

Portsmouth, Pierce Island
- Altered $PM_{2.5}$ Filter Based Sampling Frequency – DES changed the $PM_{2.5}$ FRM run frequency from once every three days to once every 12 days starting on January 1, 2011.
- Initiated PM_{10} Collocation Sampling – DES initiated PM10 collocation sampling, every six days, in concert with discontinuing PM10 collocation sampling in Manchester starting on January 1, 2011.

Future Plans

In our continuous efforts to improve performance and maximize network efficiency under a constrained budget, DES plans to implement several changes during the upcoming year – July 2011 through June 2012:

Keene, Water Street

- **Alter PM$_{2.5}$ Filter Based Sampling Frequency** – DES intends to alter the PM$_{2.5}$ FRM sampling frequency from once every six days to once every 12 days. DES placed a BAM at this station during January 2010. The BAM is considered a Federal Equivalent Method for PM$_{2.5}$ and produces real-time (hourly) data. The BAM will be considered DES' primary monitor at this station when the FRM sampler is not operating. DES plans on enacting this frequency reduction on January 1, 2012.

Londonderry, Moose Hill School

- **Lead Monitoring -** DES intends to initiate lead monitoring in concert with regulatory requirements. DES intends to utilize low volume PM10 Teflon filters for lead analyses.

Manchester, Pearl Street

- **Discontinue CO Monitoring –** On May 30, 2007, DES submitted a SIP revision to EPA that contained a modification to the CO maintenance plan for the Nashua CO maintenance area. The modifications to the maintenance plan changed the triggering mechanism by which contingency measures would be implemented and allowed the State to discontinue CO monitoring in the Nashua maintenance area. In the SIP revision, DES established an alternative triggering mechanism, which relied on CO data from a nearby CO monitor in Manchester, New Hampshire. Prior to moving CO monitoring out of Manchester, DES will submit SIP revisions to modify both Nashua and Manchester CO Maintenance Plans to establish an alternative triggering mechanism, which will rely on CO data from a proposed site.

- **Discontinue SO$_2$ Monitoring –** DES received EPA approval to shut down SO$_2$ monitoring in Manchester in conjunction with bringing the Londonderry NCore station on line. However, DES decided to continue to operate SO$_2$ at this station to gather information relative to SO$_2$ NAAQS designation determination. DES reserves the option to discontinue this monitor upon collection of sufficient SO$_2$ information from this location.

- **Discontinue PM$_{2.5}$ TEOM Monitoring –** DES would like to discontinue PM$_{2.5}$ continuous monitoring with the 8500AB TEOM at this location. This TEOM is not an EPA approved method for PM$_{2.5}$ sampling. This discontinuation makes sense in light of DES' limited resources and the fact that, upon discontinuation of CO and SO$_2$ monitoring at this station, Manchester, Pearl Street would be left with only a single parameter monitored by a non-EPA approved sampler. Also, there is currently an EPA approved BAM operating at the nearby Londonderry station that has correlated well with the Manchester TEOM; the R^2 is 0.845, with Londonderry PM$_{2.5}$ tending to be just slightly higher than Manchester PM$_{2.5}$ (see Figure 1.0).

Figure 1.0: Correlation of Londonderry BAM to Manchester TEOM

Daily 24-Hour PM2.5
Londonderry BAM versus Manchester TEOM
January - May 2011

$y = 0.9812x - 0.4485$
$R^2 = 0.8452$

Manchester TEOM PM2.5 (ug/m3)

Londonderry BAM PM2.5 (ug/m3)

Note: Not all data have been QA'd.

Nashua, Near Roadway
- Establish CO Monitoring – During the upcoming year, DES is looking into the viability of establishing a site near Route 3 in Nashua for near roadway CO monitoring. If determined viable, DES hopes to establish this site as a long term CO monitoring location and for this site to act as a triggering mechanism as described in "Manchester, Pearl Street - Discontinue CO Monitoring" above.
- Establish NO$_2$ Monitoring – During the upcoming year, DES is looking into the viability of establishing a site near Route 3 in Nashua as a near roadway NO$_2$ monitoring location. If determined viable, DES will establish this site as a long term NO$_2$ monitoring location.

Peterborough, Pack Monadnock Mountain – Summit
– Constructing a New Station for NCore – Due to space limitations in the current air monitoring structure, DES is modifying the Old State Police Building at the base of the fire tower on Pack Monadnock Mountain to meet NCore monitoring needs. DES started the construction phase for this project during October 2010 and anticipates that the new station will be completed by September 2011.

Pembroke, Exchange Street
- Initiate PM$_{2.5}$ Continuous BAM Monitoring – Subject to funding, DES would like to set up and operate an FEM BAM at this station. The BAM is considered a Federal Equivalent Method for PM$_{2.5}$ and will produce real-time (hourly), as opposed to 24-hour, data every three days.
- **Alter PM$_{2.5}$ Filter Based Sampling Frequency** – Once the BAM is operational, DES intends to alter the PM$_{2.5}$ FRM (filter based) sampling frequency from once every three days to once every six days. The BAM will be considered DES' primary monitor at this station when the FRM sampler is not operating. DES plans on enacting this frequency reduction on January 1, 2012. Please also note that DES intends to maintain PM$_{2.5}$ FRM collocation at this station at the once every six days frequency.
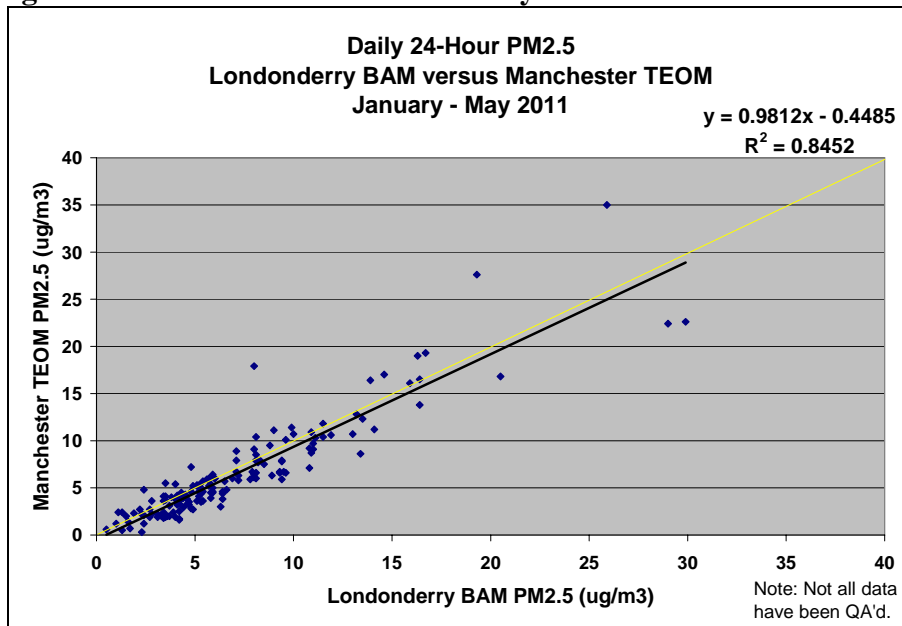
SO₂ Monitoring SO_2 *Monitoring* – DES intends to modify the current SO_2 monitoring network, if necessary, to fulfill recently promulgated regulatory requirements (SO_2 NAAQS Rule – June 2, 2010). According to this rule, there are two monitors required in the multi-state area of Boston, MA – NH, and one in Concord, NH. DES will work with EPA to determine the most appropriate way to meet the intent of these new SO_2 monitoring regulations. The current network infrastructure may be adequate. Nonetheless, DES intends to have any new SO_2 required monitoring, under this rule, operational by January 1, 2013.

Purchasing/Expenses

DES' budget cycle runs from July 1 through June 30 each year. From July 1, 2010 through June 30, 2011 DES has purchased (or is in the procurement process for) the following equipment: 2 beta attenuation monitors, a sequential filter based sampler, 3 zero air boxes, an SO_2 analyzer, a digital data logger, a hydrogen generator, a PDR 1500, 2 chart recorders, and several pumps. DES also expends considerable funding on consumables, parts, and supplies to operate the air monitoring network. Additionally, DES maintains fleet vehicles, updates maintenance and station contracts, pays utilities for existing facilities, and enhances air monitoring stations as needed throughout the network. Other key expenses include calibrating, repairing, and maintaining equipment to meet EPA and safety standards.

Please note that a number of analyzers and samplers in DES' network are old and require frequent attention in order to provide adequate data. In fact, most of DES' filter based particle samplers are in dire need of replacement. Table 1.0 presents equipment, analyzers, and samplers that DES currently uses for ambient air quality monitoring.

DES is expending considerable resources to upgrade the air monitoring site on Pack Monadnock Mountain.

Table 1.0 : Equipment – (Method)
SO₂
Teledyne – API 100A and EU – (Automated Equivalent Method EQSA-0495-100)
Teco 43A – (Automated Equivalent Method EQSA-0486-060)
Teco 43C – (Automated Equivalent Method EQSA-0486-060)
Thermo 43i – (Automated Equivalent Method EQSA-0486-060)
CO
Teco 48C - (Automated Reference Method RFCA-0981-054)
Thermo 48i – (Automated Reference Method RFCA-0981-054)
Teledyne – API 300 EU – (Automated Equivalent Method RFCA-1093-093)
O₃
Teledyne – API 400E - (Automated Equivalent Method EQOA-0992-087)
Teco 49 - (Automated Equivalent Method EQOA-0880-047)
Teco 49C - (Automated Equivalent Method EQOA-0880-047)
Thermo 49i - (Automated Equivalent Method EQOA-0880-047)
Teco 49C PS – (Lab Standard EQOA-0880-047)
NO₂
Teledyne – API 200E – (Automated Reference Method RFNA-0691-082)
Teco 42C – (Automated Reference Method: RFNA-1289-074)
Thermo 42i – (Automated Reference Method RFNA-1289-074)
Particulate Matter

Table 1.0 : Equipment – (Method)
R&P Partisol Model 2000 (filter based)
R&P Partisol Model 2025 (filter based)
BGI Model PQ200 (filter based)
R&P TEOM Model 1400
Met One BAM Model 1020
Calibrator (multiple parameter)
Monitor Labs Model 8500
TECO 165 Multi Gas Calibrator
Teledyne – API Model 700, 700E and 700U Gas Calibrators
Environics Series 6103 Multi Gas Calibrator
Data Acquisition System
Environmental Systems Corporation (ESC) Data Loggers Model 8816
ESC Data Logger Model 8832
Agilaire Software and support Agreement
PAMS
Perkin Elmer Ozone Precursor System- Clarus 500 Gas Chromatograph, TurboMatrix 100 Thermal Desorber
Perkin Elmer Total Chrom Software- version 6.2.1
Parker Balston TOC Gas Generator
Perkin Elmer Hydrogen Generator
Parker Balston Hydrogen Generator
Uninterrupted Power Supply- APC Model SURT8000XLT

Personnel

For several years now, AMP staff have adapted their efforts and taken on more responsibilities to meet critical work objectives. An official reorganization of the AMP took place during this report period that reflects actual organizational structure and individual work responsibilities. The AMP continues to operate with one full-time technical position vacant and one technical position eliminated. DES has no immediate intent to fill the vacant position, due to current budget constraints; DES assigns some technical support duties to individuals outside the official organizational structure, including data, TEOM continuous particulate matter monitor, and PAMS management duties, as illustrated in Figure 1.1.

Figure 1.1: Current Air Monitoring Program Organizational Chart

			ROBERT SCOTT DIRECTOR AIR RESOURCES
		M. FITZGERALD ADMINISTRATOR IV 13059-LG 33	
K. PERKINS AIR MONITORING ADMINISTRATOR II 13050-LG 29			

T. VERVILLE SUPERVISOR IV 13045-LG 25	J. POISSON ENV III 42220-LG 23	PAMS Manager Lara Stumpo	TEOM Manager Jessica Sheldon	DATA Manager Dan Terrell

C. THOROUGHGOOD ELEC TECH II 42219-LG 20	T. FAZZINA AP TECH II 13054-LG 17	S. KLOSE AP TECH II 13041-LG 17	M. LITTLE DATA ANALYST 13055-LG 24	INTERN LG-10	VACANT AP TECH I 13049-LG 15

Cooperative Air Monitoring Initiatives

DES is involved in numerous cooperative air monitoring initiatives with local, state, and private entities.

For over 21 years now, AMC and DES have been joining resources to conduct ozone monitoring in Coos County. Since 1990, AMC and DES have been cooperatively monitoring ozone on the summit of Mount Washington to determine the exposure of hikers and other visitors to this pollutant and to quantify ozone transport from upwind areas. Significant levels of ozone have been measured on the summit during the summer months throughout this time. Also, AMC and DES began cooperatively managing a second monitoring station near the base of Mount Washington (Camp Dodge) in 1996, a White Mountain National Forest Class I Wilderness visibility monitoring station. Without AMC's involvement, DES would incur triple the costs to maintain these stations.

DES also partners with the United States Department of Agriculture (Forest Service) in a Challenge Cost Share Agreement relative to air monitoring activities at Camp Dodge in Green's Grant. This agreement provides a framework of cooperation for station work such as upgrades, tree trimming, and routine costs. This agreement ensured the stability of the Camp Dodge station until May 1, 2011. DES is currently working with the Forest Service to renew the Challenge Cost Share Agreement for this site. The Forest Service operates an IMPROVE (Interagency Monitoring of Protected Visual Environments) sampler at this site. DES and AMC currently maintain ozone sampling, upkeep, and routine site inspections at this station.

DES provides critical real-time rainfall data to the New Hampshire Department of Corrections for the protection of public health. When rainfall at the Laconia, Green Street station exceeds a specific amount over a specific time period, an automated notification system operated by DES facilitates closing of a public beach and alerts of possible bacterial dangers. Similar notification systems incorporating our real-time meteorology data have been used to enact erosion control inspections at various New Hampshire Department of Transportation road construction projects.

Monitoring Trends
Each year, DES reviews its monitoring data and calculates design values for comparison to the National Ambient Air Quality Standards (NAAQS) – Table 1.1. These standards are established to protect public health and welfare. In general, design values consider the three most recent years for an averaging period in the form of the NAAQS, such as looking at the 4th highest annual ozone value of an 8-hour duration.

New Hampshire air quality data trends reveal the important progress that has been made in improving air quality in New Hampshire. Cleaner vehicles, fuels, power plants, industry, and small engines located throughout the region have all contributed to much improved air quality since the 1980s. More recent trends show that additional progress is still being made, but the task becomes more difficult as there are becoming fewer pollution sources that remain uncontrolled. It is also important to note that while progress has been made, the NAAQS have been lowered to be more protective, thus we have more progress to make.

Figures 1.2 through 1.15 present monitoring trends for the key criteria pollutants for the period 1997 through 2010. In all cases, air quality is significantly improved from the 1970s and 1980s. Currently monitored levels of nitrogen dioxide (NO_2) and carbon monoxide (CO) are safely below the current levels of the NAAQS. However, the NAAQS for ozone and $PM_{2.5}$ have recently been tightened (lowered) to levels near what is currently being measured in New Hampshire. It is these two pollutants that have drawn significant attention by DES as a focus for monitoring and SIP planning. In addition, the NAAQS for lead is also proposed to be lowered. New Hampshire does not currently monitor for lead, but historical monitoring in the state suggest that lead concentrations are now well below the proposed new NAAQS. Current monitoring for NO_2 indicates that New Hampshire meets the level of the recently altered 1-hour NAAQS, although the New Hampshire network does not yet include a road-side NO_2 monitor.

An SO_2 1-hour NAAQS was recently added with a threshold of 0.075 ppm. While New Hampshire's ozone levels safely meet the 3-hour, 24-hour, and annual NAAQS, the attainment status for the new SO_2 NAAQS is questionable at the moment. Current monitoring indicates some locations are above the 0.075 ppm threshold. However, much of the elevated levels of SO_2 is caused by a coal-burning power plant that is currently installing a SO_2 scrubber which will be operational and reducing SO_2 emissions by at least 90% in the next 2-3 years.

Tables 1.2 through 1.5 provide the five-year maximum and most recent (2010) design values for each criteria pollutant. These are also expressed as percentages of the current NAAQS. CO and NO_2 design values are all under 50% of the NAAQS. This is also true of the annual SO_2 design values, and the 3-hour and 24-hour SO_2 design value stay under 60% of the NAAQS. However, the highest SO_2 site, Pembroke, does exceed more than twice the NAAQS in 2010. Also, with the lower ozone standard of 0.075 ppm, Pack Monadnock summit just barely exceeds the standard in 2010, by no more than 7%.

New Hampshire operates two Photochemical Assessment Monitoring Stations (PAMS): Pack Monadnock and Nashua. Tables 1.10 and 1.11 show that none of the toxic PAMS parameters are near their Ambient Allowable Limits (AAL) at either site. Benzene has the lowest AAL, 5.7 ug/m3. At Pack Monadnock, the maximum 24-hour average for benzene over the full period was 0.73 ug/m3, which is about 12% of the AAL. At Nashua, benzene's maximum value was 0.74

ug/m3, also about 12% of the AAL. Maximum values for all the other parameters for both sites are consistently less than 1% of their AAL.

Table 1.1: National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour [1]	None	
	35 ppm (40 mg/m^3)	1-hour [1]		
Lead	0.15 µg/m^3 [2]	Rolling 3-Month Average	Same as Primary	
Nitrogen Dioxide	53 ppb [3]	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour [4]	None	
Particulate Matter (PM$_{10}$)	150 µg/m^3	24-hour [5]	Same as Primary	
Particulate Matter (PM$_{2.5}$)	15.0 µg/m^3	Annual [6] (Arithmetic Average)	Same as Primary	
	35 µg/m^3	24-hour [7]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour [8]	Same as Primary	
	0.08 ppm (1997 std)	8-hour [9]	Same as Primary	
	0.12 ppm	1-hour [10]	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Average)	0.5 ppm	3-hour [1]
	0.14 ppm	24-hour [1]		
	75 ppb [11]	1-hour	None	

[1] Not to be exceeded more than once per year.

[2] Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[3] The official level of the annual NO$_2$ standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard

[4] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).

[5] Not to be exceeded more than once per year on average over 3 years.

[6] To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

[7] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

[8] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)

[9] (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
  (b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
  (c) EPA is in the process of reconsidering these standards (set in March 2008).

[10] (a) EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
  (b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$ 1.

[11] (a) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

Table 1.2: Ozone Design Values

Ozone (ppb)	Design Value Description	NAAQS	5-Year Max	% of NAAQS	Location	2010 Max	% of NAAQS	Location
8-Hour	3-year average of 4th-highest daily maximum 8-hour averages	75	80	107%	Pack Monadnock	76	101%	Pack Monadnock

Table 1.3: Carbon Monoxide Design Values

CO (ppm)	Design Value Description	NAAQS	5-Year Max	% of NAAQS	Location	2010 Max	% of NAAQS	Location
1-Hour	2nd maximum	35	9.1	26%	Nashua	3.1	9%	Manchester
8-Hour	2nd maximum	9	3.5	39%	Manchester	2.4	27%	Manchester

Table 1.4: Sulfur Dioxide Design Values

SO_2 (ppm)	Design Value Description	NAAQS	5-Year Max	% of NAAQS	Location	2010 Max	% of NAAQS	Location
1-Hour	3-year average of 99th percentile of daily maximum 1-hour averages	0.075	0.193	258%	Pembroke	0.193	258%	Pembroke
3-Hour	2nd maximum	0.5	0.260	52%	Pembroke	0.260	52%	Pembroke
24-Hour	2nd maximum	0.14	0.109	78%	Pembroke	0.109	78%	Pembroke
Annual	Annual average	0.03	0.008	27%	Pembroke	0.010	33%	Pembroke

Table 1.5: Nitrogen Dioxide Design Values

NO_2 (ppb)	Design Value Description	NAAQS	5-Year Max	% of NAAQS	Location	2010 Max	% of NAAQS	Location
1-Hour	3-year average of 98th percentile of daily maximum 1-hour averages	100	46	46%	Manchester	45	45%	Manchester
Annual	Annual average	53	11	21%	Manchester	8	15%	Manchester

Figure 1.2: Ozone trends for the 8-Hour NAAQS (1997-2010)

Ozone Trends for Southern and Southeastern New Hampshire
(1997-2010 Annual 4th-Highest 8-Hour Ozone)
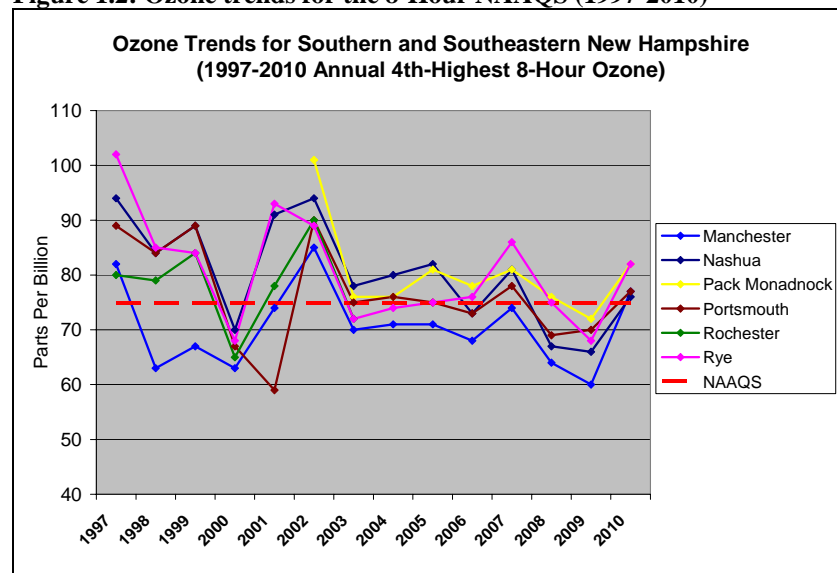
Figure 1.3: Ozone trends for the 8-Hour NAAQS (1997-2010)

Ozone Trends for Northern and Western New Hampshire
(1997-2010 Annual 4th-Highest 8-Hour Ozone)
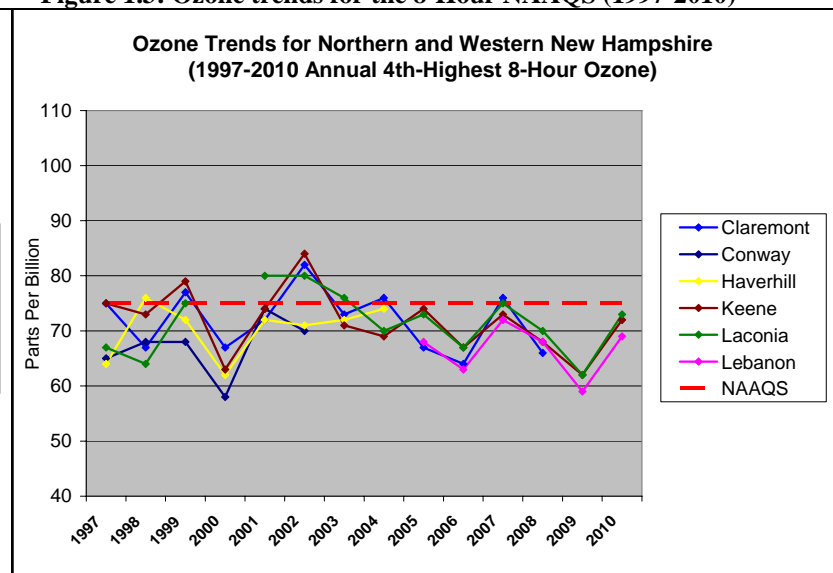
Figure 1.4: Carbon Monoxide trends for the 1-hour NAAQS (1997-2010)

Annual 1-Hour Maximum CO Trends in New Hampshire
(1997-2010)
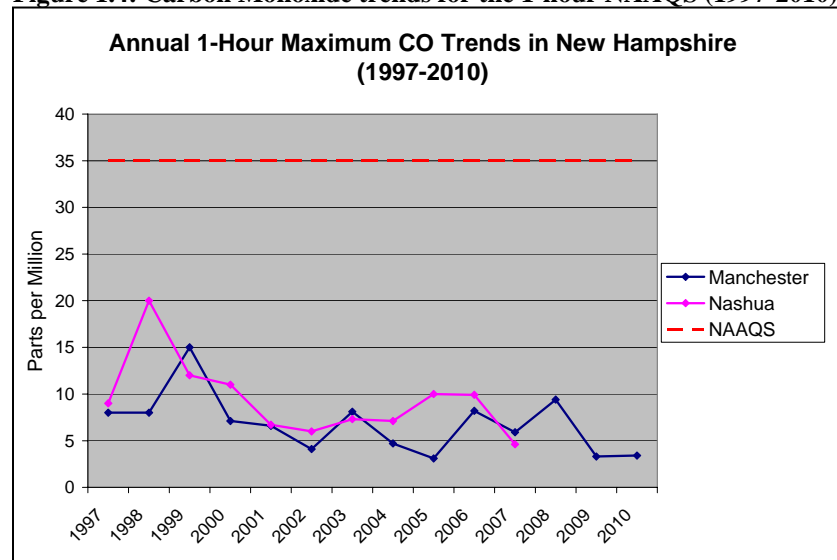
Figure 1.5: Carbon Monoxide trends for the 8-hour NAAQS (1997-2010)

Annual 8-Hour Maximum CO Trends in New Hampshire
(1997-2010)
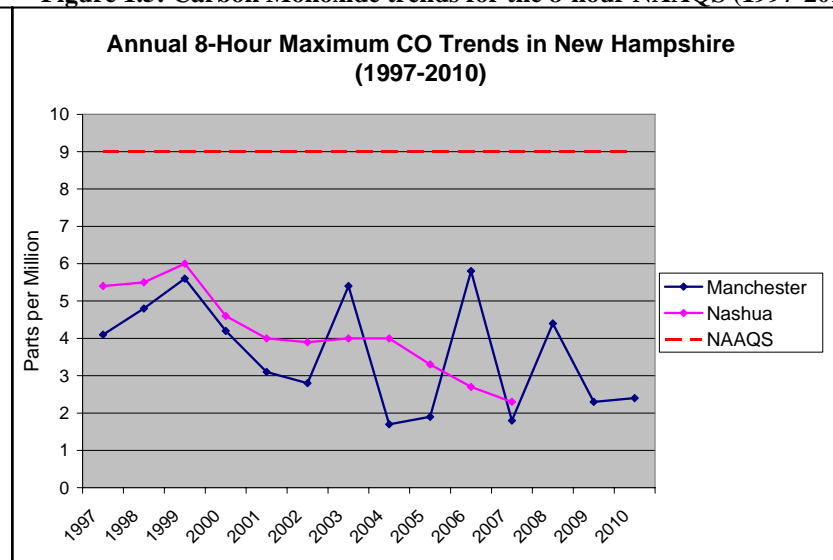
Figure 1.6: PM_{2.5} trends for the 24-Hour NAAQS (2001-2010)

Recent 24-Hour PM2.5 Trends (98th Percentile) for Southern and Southeastern New Hampshire (2001-2010)
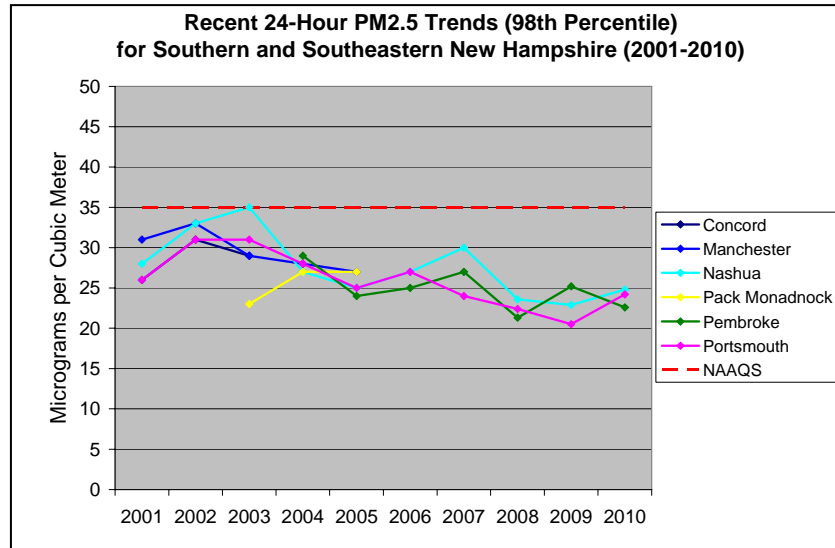
Figure 1.7: PM_{2.5} trends for the 24-Hour NAAQS (2001-2010)

Recent 24-Hour PM2.5 Trends (98th Percentile) for Northern and Western New Hampshire (2001-2010)
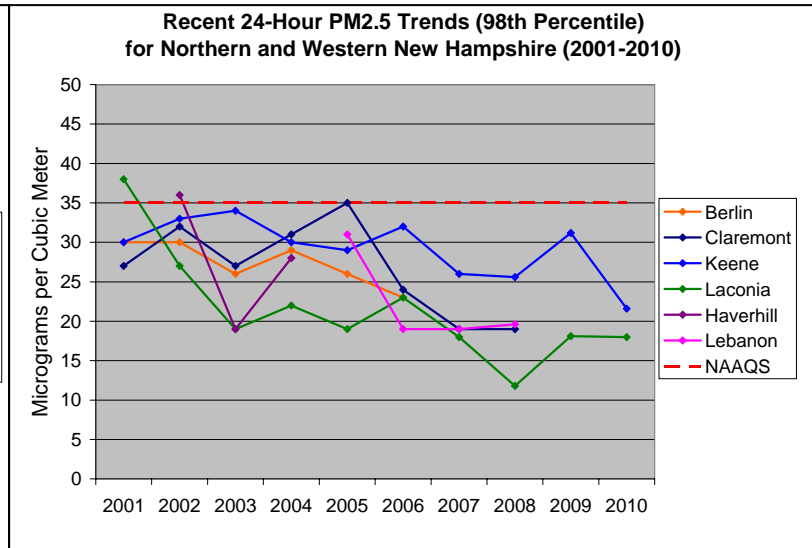
Figure 1.8: PM_{2.5} trends for the annual NAAQS (2001-2010)

Recent Annual PM2.5 Trends (Annual Mean) for Southern and Southeastern New Hampshire (2001-2010)
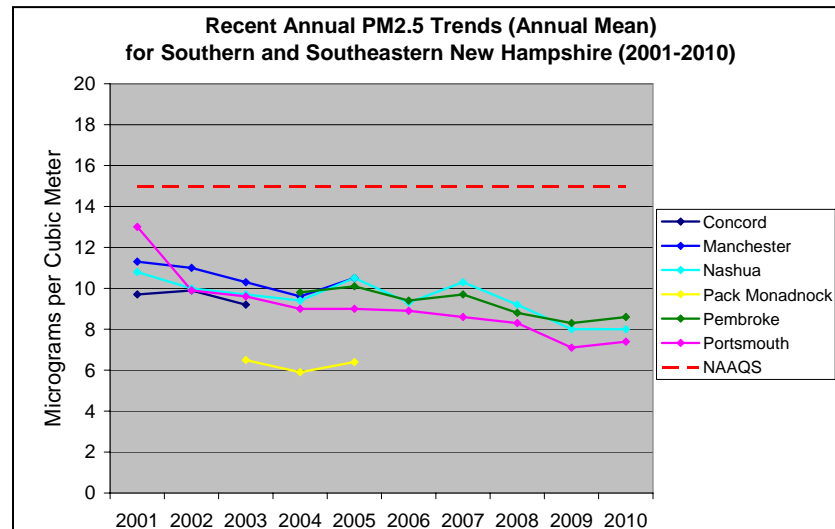
Figure 1.9: PM_{2.5} trends for the annual NAAQS (2001-2010)

Recent Annual PM2.5 Trends (Annual Mean) for Northern and Western New Hampshire (2001-2010)
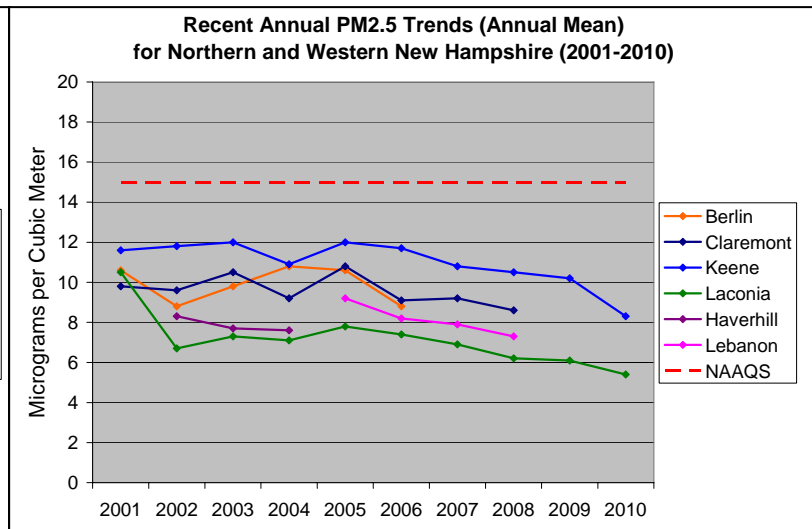
Figure 1.10: Nitrogen Dioxide trends for the annual NAAQS (2001-2010)

Recent Annual NO2 Trends for New Hampshire
(2001-2010 Annual Means)

Figure 1.11: Sulfur Dioxide trends for the 3-Hour NAAQS (2001-2010)

Recent Annual SO2 Trends for New Hampshire
(2001-2010 Maximum 3-Hour Averages)

Figure 1.12: Sulfur Dioxide trends for the 24-hour NAAQS (2001-2010)

Recent Annual SO2 Trends for New Hampshire
(2001-2010 Maximum 24-Hour Averages)

Figure 1.13: Sulfur Dioxide trends for the annual NAAQS (2001-2010)

Recent Annual SO2 Trends for New Hampshire
(2001-2010 Annual Means)

Figure 1.14: Nitrogen Dioxide trends for the 1-hour NAAQS (2001-2010)   **Figure 1.15: Sulfur Dioxide trends for the 1-hour NAAQS (2001-2010)**
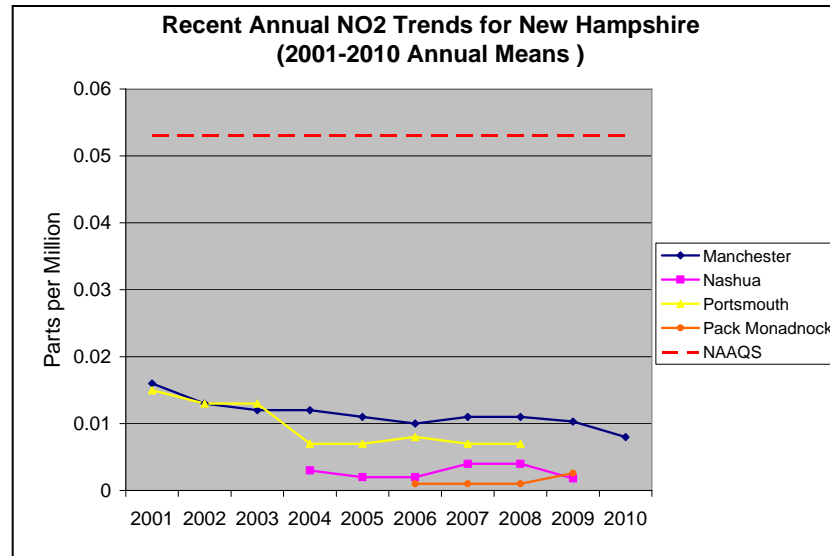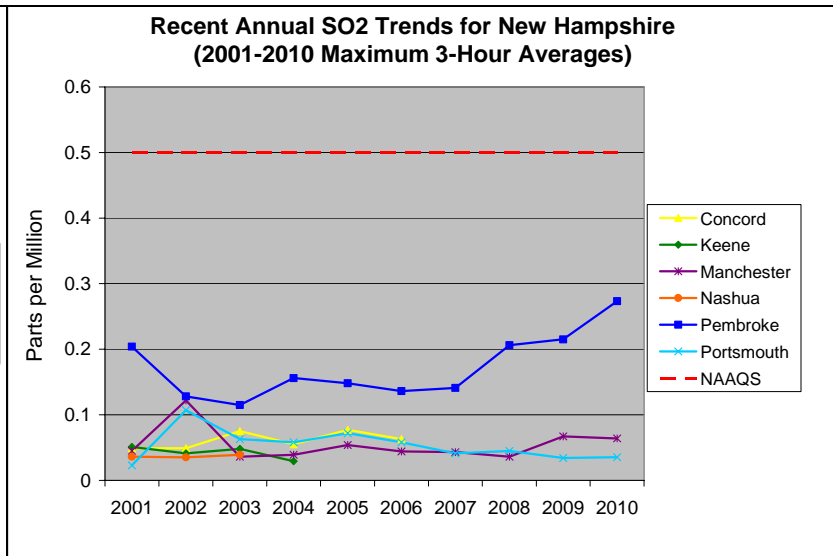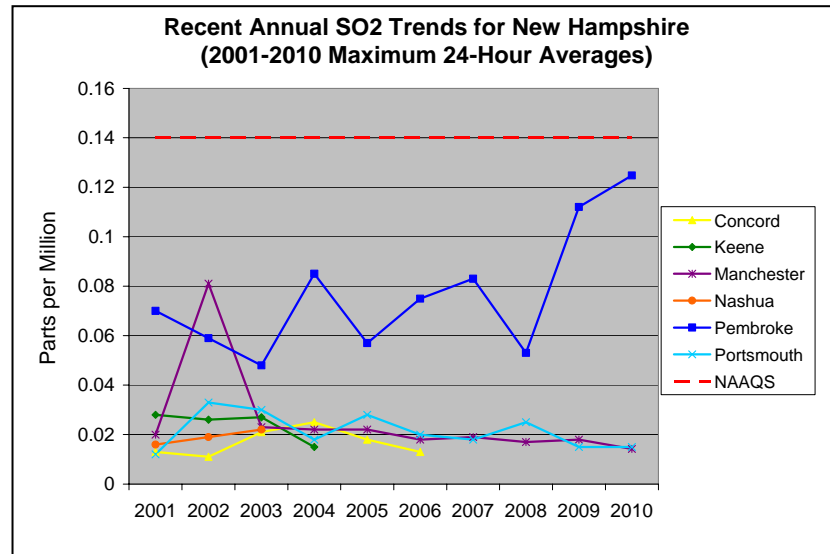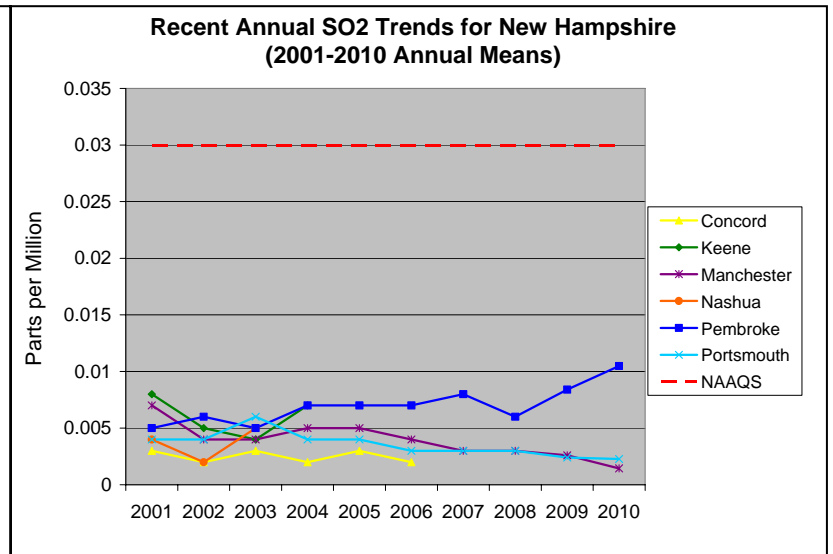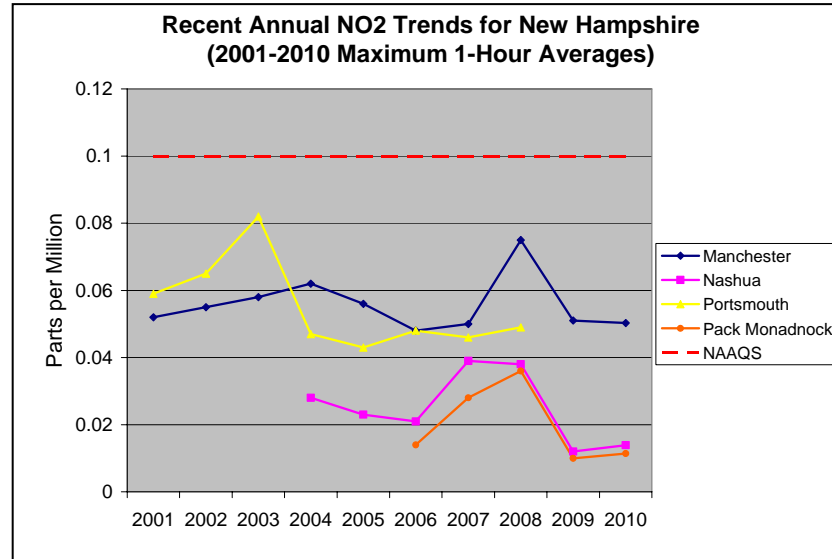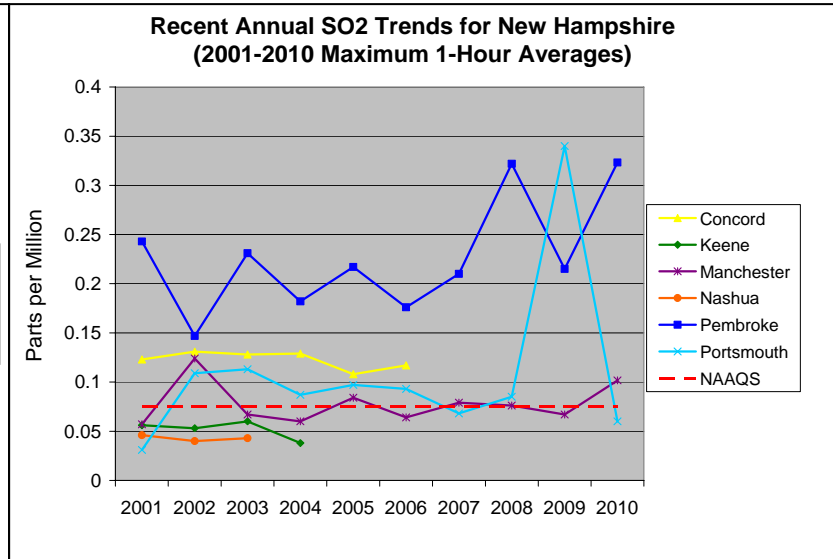

Recent Annual NO2 Trends for New Hampshire (2001-2010 Maximum 1-Hour Averages)

Recent Annual SO2 Trends for New Hampshire (2001-2010 Maximum 1-Hour Averages)

Table 1.6: New Hampshire State and Local Air Monitoring Stations Network – 2010/2011					
SO₂					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Manchester	Pearl Street	33 011 0020	Continuous	Urban	Population
Pembroke	Pembroke Highway Dept.	33 013 1006	Continuous	Neighborhood	High Concentration
Portsmouth	Pierce Island	33 015 0014	Continuous	Neighborhood	Population
Concord	Hazen Drive	33 013 1007	Continuous	Neighborhood	Population
CO					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Manchester	Pearl Street	33 011 0020	Continuous	Middle	High Concentration
O₃					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Concord	Hazen Drive	33 013 1007	Continuous	Neighborhood	Population
Greens Grant	Camp Dodge	33 007 4002	Continuous	Regional	Research
Keene	Water Street	33 005 0007	Continuous	Neighborhood	Population
Laconia	Lakes Region	33 001 2004	Continuous	Regional	Population
Lebanon	Lebanon	33 009 0010	Continuous	Neighborhood	Population
Mount Washington	Mt. Washington Summit	33 007 4001	Continuous	Regional	Research
Nashua	Gilson Road	33 011 1011	Continuous	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research
Portsmouth	Pierce Island	33 015 0014	Continuous	Neighborhood	Population
Rye, Odiorne	Seacoast Science Center	33 015 0016	Continuous	Neighborhood	High Concentration
NO₂					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Nashua	Gilson Road	33 011 1011	Continuous	Neighborhood	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research

Table 1.7: New Hampshire Particulate Matter Network – 2010/2011

		PM₂.₅			

Town	Name	AIRS #	Frequency	Scale	Objective
Keene	Water Street	33 005 0007	1 in 6	Neighborhood	Population
Keene	Water Street	33 005 0007	Continuous - BAM	Neighborhood	Population
Laconia	Green Street	33 001 2004	1 in 6	Regional	Population
Lebanon	Lebanon Airport	33 009 0010	Continuous - BAM	Neighborhood	Population
Londonderry	Moose Hill School	33 015 0018	1 in 3	Regional	Population
Londonderry	Moose Hill School	33 015 0018	Continuous - BAM	Regional	Population
Manchester	Pearl Street	33 011 0020	Continuous - TEOM	Urban	Population
Nashua	Crown Street	33 011 1015	1 in 6	Urban	High Concentration
Pembroke	Pembroke Highway Dept.	33 013 1006	1 in 3	Neighborhood	High Concentration
Pembroke	Pembroke Highway Dept.	33 013 1006	1 in 6	Neighborhood	Colocate Audit
Peterborough	Pack Monadnock	33 011 5001	Continuous - BAM	Regional	Research
Peterborough	Pack Monadnock	33 011 5001	1 in 3	Regional	Research
Portsmouth	Pierce Island	33 015 0014	Continuous - BAM	Regional	Population
		PM₂.₅ Speciation			
Peterborough	Pack Monadnock	33 011 5001	1 in 3 IMPROVE	Regional	Research
Londonderry	Moose Hill School	33 015 0018	1 in 3 IMPROVE	Regional	Population
		PM10			
Londonderry	Moose Hill School	33 015 0018	1 in 3	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	1 in 3	Regional	Research
Portsmouth	Pierce Island	33 015 0014	1 in 6	Neighborhood	Population
Portsmouth	Pierce Island	33 015 0014	1 in 6	Neighborhood	Audit

Table 1.8: New Hampshire PAMS Network – 2010/2011

Town	Name	AIRS #	Frequency	Scale	Objective
Nashua	Gilson Road	33 011 1011	Continuous	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research

Table 1.9: New Hampshire NCore Network – 2010/2011

Town	Name	AIRS #	Status	Scale	Objective
Londonderry	Moose Hill School		Operational on Jan 1, 2011	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Operational on Jan 1, 2011	Regional	Research

Table 1.10: Seasonal Maximum 24-hour Averages at Gilson Road in Nashua for Toxic PAMS Species Compared to the Ambient Allowable Limit (AAL), 2005-2010

PAMS Parameter	AAL ug/m3	Max 24 Hour Avg. (ug/m3)						Max as % of AAL
		2005	2006	2007	2008	2009	2010	
PROPYLENE (43205)	35,833	0.55	0.34	0.30	0.33	0.35	0.20	0.00%
CYCLOPENTANE (43242)	25,595	0.23	0.23	0.16	0.13	0.15	0.10	0.00%
ISOPENTANE (43221)	36,875	2.04	2.50	1.56	1.41	1.23	1.13	0.01%
PENTANE (43220)	36,875	3.13	1.39	0.85	0.74	0.76	0.61	0.01%
2-METHYLPENTANE (43285)	36,875	0.60	0.78	0.21	0.35	0.25	0.18	0.00%
3-METHYLPENTANE (43230)	36,875	0.41	0.48	0.20	0.30	0.20	0.25	0.00%
HEXANE (43231)	885	0.59	0.58	0.47	0.74	0.51	1.18	0.13%
BENZENE (45201)	5.7	0.51	0.74	0.36	0.42	0.37	0.29	12.91%
CYCLOHEXANE (43248)	6,000	0.25	0.21	0.21	0.48	0.19	0.29	0.01%
HEPTANE (43232)	8,249	0.56	0.34	0.18	0.32	0.25	0.12	0.01%
METHYLCYCLOHEXANE (43261)	23,958	0.21	0.21	0.11	0.16	0.10	0.06	0.00%
TOLUENE (45202)	5,000	2.37	2.67	1.39	1.97	1.60	1.77	0.05%
OCTANE (43233)	7,000	0.32	0.13	0.10	0.13	0.09	0.07	0.00%
ETHYLBENZENE (45203)	1,000	0.36	0.36	0.18	0.39	0.57	0.14	0.06%
M & P-XYLENES (45109)	1,550	0.88	0.96	0.68	1.15	2.04	0.45	0.13%
STYRENE (45220)	1,000	0.88	0.13	0.22	0.07	0.06	0.13	0.09%
O-XYLENE (45204)	1,550	0.32	0.36	0.26	0.40	0.40	0.16	0.03%
NONANE (43235)	15,625	0.21	0.13	0.21	0.10	0.11	0.07	0.00%
1,3,5-TRIMETHYLBENZENE (45207)	619	0.11	0.12	0.09	0.32	0.17	0.09	0.05%
1,2,4-TRIMETHYLBENZENE (45208)	619	0.32	0.39	0.32	0.39	0.31	0.18	0.06%

Table 1.11: Seasonal Maximum 24-hour Averages at Pack Monadnock in Miller State Park for Toxic PAMS Species Compared to the Ambient Allowable Limit (AAL), 2006-2010

PAMS Parameter	AAL (ug/m3)	Max 24-Hour Avg. (ug/m3)					Max as % of AAL
		2006	2007	2008	2009	2010	
PROPYLENE (43205)	35,833	0.28	0.25	0.46	0.15	0.20	0.00%
CYCLOPENTANE (43242)	25,595	0.42	0.53	1.63	0.09	0.29	0.01%
ISOPENTANE (43221)	36,875	1.03	1.09	0.70	0.89	0.75	0.00%
PENTANE (43220)	36,875	45.41	7.63	0.55	0.45	0.38	0.12%
2-METHYLPENTANE (43285)	36,875	0.19	0.27	0.04	0.06	0.04	0.00%
3-METHYLPENTANE (43230)	36,875	0.13	0.17	0.01	0.04	0.03	0.00%
HEXANE (43231)	885	0.21	0.27	0.19	0.32	1.36	0.15%
BENZENE (45201)	5.7	0.31	0.33	0.32	0.41	0.73	12.79%
CYCLOHEXANE (43248)	6,000	0.14	0.05	0.02	0.08	0.04	0.00%
HEPTANE (43232)	8,249	0.71	0.16	0.15	0.17	0.13	0.01%
METHYLCYCLOHEXANE (43261)	23,958	1.23	0.15	0.15	0.11	0.16	0.01%
TOLUENE (45202)	5,000	1.00	1.05	1.11	1.01	0.77	0.02%
OCTANE (43233)	7,000	0.91	0.17	0.27	0.11	0.06	0.01%
ETHYLBENZENE (45203)	1,000	0.35	0.20	0.59	0.21	0.15	0.06%
M & P-XYLENES (45109)	1,550	1.88	0.37	2.38	0.46	0.23	0.15%
STYRENE (45220)	1,000	1.03	1.13	1.80	0.40	0.08	0.18%
O-XYLENE (45204)	1,550	0.60	0.13	0.67	0.15	0.08	0.04%
NONANE (43235)	15,625	8.83	1.33	0.57	0.23	0.08	0.06%
1,3,5-TRIMETHYLBENZENE (45207)	619	1.75	0.08	0.29	0.13	0.04	0.28%
1,2,4-TRIMETHYLBENZENE (45208)	619	3.91	1.34	0.79	0.53	0.14	0.63%